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FIELD EARLY AND EVEN RIPENING OF DATE PALM FRUITS

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ABSTRACT

In order to induce early and even ripening of “Shahani” date fruits, this experiment was conducted in complete randomized blocks design in factorial arrangement with three replications. NaCl 1.5 and 3%, acetic acid (AA) 2 and 4 %, NaCl 1.5% plus AA 2%, ethanol 70%, date vinegar (DV) 40 and 60% and DV 30% plus NaCl 1.5% were sprayed on the fruit clusters in early of color break (early of Khalal stage) and two weeks later (end of Khalal stage) and effects of these treatments were studied on fruit ripening rate, Khalal, Rotab and Tamar percent, total soluble solid (TSS) and pH of fruit. Results showed that, NaCl 3%, AA 4% and DV 60% were induced early and even fruit ripening more than other treatments and control especially in second spray time. In these treatments, fruits were harvest one month sooner. General concluded that in all treatments, NaCl 3% in fully khalal stage was the best treatment.

Keywords: *Date Palm, Early Ripening, Even Ripening*

INTRODUCTION

As regards early ripening of fruits among dates, are used growth regulators such as ethylene, cytokinin and auxin. This material is expensive, their application is difficult for gardener and have might side problems for plant and consumer (Arteca, 1995; Kamal, 1995). Other materials are not growth regulators and have used for ripening of date palm fruit outside of tree. NaCl and acetic acid is among material that have used for ripening of date palm fruit outside of tree. “Jahrom” province has suitable station for date palm cultivation in Iran. In this province “Shahani”, cultivars have highest cultivation area and dates production. Between “Shahani” date fruit and palm gardener problems in this province is late ripening and not even ripening of dates. In some years, date fruit ripening and harvesting is accosted with autumn rainfall (November) and is spoiled more percent of crop. Further occurrence of high percent of Khalal at harvesting time and not occurrence of suitable resource for use and sale of this part of crop, every year is obsolete part of crop. Hereupon this study has been done for find of applied and cheap method for early and even ripening of “Shahani” date fruits in “Jahrom” province.

MATERIALS AND METHODS

This experiment was conducted in randomized complete blocks design in factorial arrangement with three replications on clusters of 15-years “Shahani” date palm trees in “Jahrom” province. For this purpose, in early June were selected 20 fertile and uniform palms, were selected three clusters on each tree for randomization of replications, and were marked based on design-randomized map. Treatments were included, acetic acid(AA) 2 and 4%, NaCl 1.5 and 3%, date vinegar(DV) 40 and 60%, AA 2% plus NaCl 1.5%, DV 30% plus NaCl 1.5%, ethanol 70% and distilled water as control. Above treatments were applied in two time on individual clusters as spray on total cluster.

First spray were done in start of color break as, all fruits on cluster were light yellow color. After two weeks, second spray was done on other selected clusters.

In this time, fruits on cluster were in khalal stage. After spray in any stage, 10 strands were selected and marked for determination of fruit ripening process. Then into weekly ripen fruits on this strands were counted and eliminated. In harvested fruits were determined TSS and pH. For determination of TSS were taken 9 g fruit texture of 10 fruits in per replication and after breaking, were stored in container contain 45 ml distilled water for 15 hour.

At the end of 15 hour, were blended this mixture and were filtered. In obtained extract, were determined TSS by refractometer. For determination of actual TSS, was multiplied obtained number in six. Samples pH, were determined by pH meter.

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At the end of experiment (27 September), clusters were harvested individually in per replication and separated their fruits. Separated fruits were divided into 3 groups containing Tamar, Rotab and Khalal, and were weighted individually and then converted to percentage. For determination of fruit aspect quality, fruits of any treatment on tree and after harvest were evaluated by five people and after averaging, were distinguished aspect quality arrangement.

Data were analyzed in randomized complete blocks design by MSTAT-C software and means were compared by Duncan's multiple rang test in 5% level.

RESULTS AND DISCUSSION

Results

Effect of Treatments Fruit Ripening Rate

Fruit ripening rate was different between control and other treatments. AA 4%, NaCl 3%, DV 40% and NaCl 1.5% plus AA 2% were increased fruit ripening rate very high as compared to control in two time of spray especially in second time. In these treatments at the end of fifth account in second spray (35 days after spray), had been ripened all fruits on 10 marked strands. NaCl 1.5% plus DV 30%, NaCl 1.5%, AA 2% and DV 60% has not difference with control in fruit ripening rate. Ethanol 70% was decrease fruit ripening rate very high than control.

Effect of Treatments on Fruit Ripening Percent

Tamar Percent

At the end of experiment, percent of converted fruits to Tamar depending on treatment type were different. Highest Tamar percent were observed in NaCl 3% (67.45) and AA 4% (65.92), respectively. Tamar percent in other treatments except ethanol 70% were in equally level without significant difference with control, and lowest Tamar percent (42.65) were observed in ethanol 70%. Spray time have influence on converted fruits to Tamar and generally with Tamar percent, second spray time with significant difference were in higher level than first spray time (table 1).

Rotab Percent

At the end of experiment, percent of Rotab were different depending on treatment type. Highest Rotab percent were in DV 40% (21.67) and lowest in ethanol 70% (14.31). Except DV 40%, other treatments were in equal level with Rotab percent. In some treatments among DV 40 and 60% and NaCl 1.5%, Rotab percent in second spray time were more than first time and in other treatments Rotab percent have not difference in two time of spray. Generally, spray time have not significant influence on Rotab percent in any treatment (table 2).

Khalal Percent

Treatments type had high influence on remnant Khalal percent in any treatment. Highest Khalal percent (43.04) were observed in ethanol 70% and lowest in NaCl 3% and AA 4%. Spray time had significant influence on remnant Khalal percent at the end of experiment and in this view, second spray time with significant difference were in lower level than first spray time (table 3).

Effect of Treatments on Total Percent of Ripens Fruit

Treatment type had influence on total percent of ripen fruits. Highest ripen fruits percent (84.65) were in NaCl 3% and lowest (53.76) in ethanol 70%. In this view there was no difference between spray time, but in some treatments total percent of ripen fruits in second spray time were lower than first time, reverse in NaCl 3% and NaCl 1.5% plus DV 30% total percent of ripen fruits in second spray time were higher than first time (table 4).

Effect of Treatments on TSS

In all treatments except NaCl 3%, TSS was lower as compared to control. Lowest TSS was observed in AA 4%. In this view to TSS, there was no significant difference between first and second spray time (table 5).

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Effect of Treatments on pH of Fruit Texture

Fruit texture pH has difference by treatment type. Highest pH (6.93) was in fruit texture treated with NaCl 3% and DV 60% and lowest (6.5) in fruit texture treated with DV 40%. Generally, spray time have significant influence on acidity of fruit texture (table 6).

Effect of Treatments on Fruit Aspect Quality

Concerning aspect evaluations, fruit aspect quality was affected by treatment type. Hereupon, treatments contain AA and DV, were blotted fruit aspect and date color in these treatments were darker as compared to NaCl, ethanol and control treatments. Generally, treated fruits by NaCl 3%, especially, in second spray time were more vivid and have better aspect between all treatments.

Discussion

Concerning obtained results, acetic acid 4%. NaCl 3% and partly date vinegar have highest effect on early and even ripening of “Shahani” date fruit.

In this view acetic acid effects on early ripening, have been reported that, acetic acid were made a autocatalytic mechanism of ethylene in fruit indirectly through cell wall destruction due to acidic position and whereas ethylene production in date fruit that is a climacteric fruit, have non reversible position and ethylene production process are continued until fruit ripening and were affected speeding of fruit ripening diagram grade (Reuveni, 1985).

Direct effect of acetic acid is referred to its manner effect of being enzymes in cell. Among these enzymes, invertase, that is softening fruit through conversion of sucrose to fructose and glucose. Invertase enzyme there is in cell protoplast into insoluble components, and with ripening beginning, invertase is arrived to space of between cells and conveniently in soluted in water being in there and is activated. Hereupon acetic acid with membrane damaging, is quacked invertase acidity start (Abou-Aziz *et al.*, 1975; Reuveni, 1985).

Table 1: Effect of treatment type and spray time on Tamar percent

Spray time Treatment	First time Tamar percent	Second time	Mean
Control	43.22 e	55.36 c	49.29 CD
AA 2%	48.98 d	47.32 e	48.15 D
AA 4%	63.7 b	68.14 a	65.92 A
NaCl 1.5%	37.95 g	54.01 b	45.98 E
NaCl 3%	67.07 a	67.83 a	67.45 A
DV 40%	42.01 ef	48.69 de	45.35 EF
DV 60%	54.39 c	49.58 d	51.99 C
AA + NaCl	41.46 ef	45.5 ef	43.48 F
DV + NaCl	42.18 ef	50.29 d	46.23 DE
Ethanol 70%	35.02 gh	50.27 d	42.65 FG
Mean	47.6 B	53.7 A	

Means with similar letters in each row and column are not significantly different at 5% level of DMRT. Obtained results in acetic acid 4% treatment, are showed increase of ripening rate and also arise of ripen fruits percent than control, that are conformed with obtained results by Shamshiri and Mohammadi (Shamshiri and Rahemi, 1998; Mohammadi, 1997), Asif and Al-Taher (1983) and Chata *et al.*, (1985). NaCl 3% were accelerated fruit ripening than control.

These results are conformed to obtained results by Asif and Al-Taher (1983), Chata *et al.*, (1985) and reported results by Bakana, Brown and Sidic, Nadad and Hasan (Dowson and Aten, 1962). Have been reported that NaCl is effective on ripening acceleration through influence on cell wall. In plant cells wall, there are calcium bands that are operated its solidity. With NaCl application, are occurred ionic movement between sodium and calcium ions, and then changes were occurred in membrane solidity and enzymes activity especially polygalactronase. Whereas polygalactronase have original role in resuming of

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chain of converting of insoluble pectin to soluble pectin and this function is operated fruit texture softening, NaCl application is operated increase ripening rate and TSS (Moujheith and Hassaballa, 1979).

Concerning to obtained results, fruit acidity was affected by some treatments. Have been reported that date fruit in any stage have especial pH that pH in fruit ripening time are enhanced due to decrease of organic acids.

Table 2: Effect of treatment type and spray time on Rotab percent

Spray time Treatment	First time Rotab percent	Second time	Mean
Control	16.15 bc	19.55 b	17.85 BC
AA 2%	18.07 b	11.47 e	14.77 DE
AA 4%	18.42 b	13.59 d	16.01 CD
NaCl 1.5%	14.18 cd	17.1 c	15.64 D
NaCl 3%	15.91 c	13.52 d	14.72 DE
DV 40%	16.99 de	26.35 a	21.67 A
DV 60%	12.71 de	18.81 bc	15.76 D
AA + NaCl	21.41 a	17.49 c	19.45 AB
DV + NaCl	17.28 bc	16.63 cd	16.96 CD
Ethanol 70%	14.83 cd	13.79 d	14.31 DE
Mean	16.6 A	16.83 A	

Means with similar letters in each row and column are not significantly different at 5% level of DMRT.

Table 3: Effect of treatment type and spray time on Khalal percent

Spray time Treatment	First time Khalal percent	Second time	Mean
Control	40.58 c	25.09 c	32.83 D
AA 2%	29.77 e	29.14 cd	29.46 E
AA 4%	17.88 f	18.27 g	18.08 F
NaCl 1.5%	47.87 b	28.89 d	38.38 B
NaCl 3%	17.02 f	18.65 g	17.83 F
DV 40%	41 c	24.96 ef	32.98 D
DV 60%	32.9 d	31.61 c	32.25 D
AA + NaCl	37.13 cd	37.01 a	37.07 BC
DV + NaCl	40.18 c	33.08 bc	36.63 C
Ethanol 70%	50.13 a	35.94 ab	43.04 A
Mean	35.45 A	28.26 B	

Means with similar letters in each row and column are not significantly different at 5% level of DMRT.

Table 4: Effect of treatment type and spray time on total percent of ripen fruits

Spray time Treatment	First time Ripen fruit percent	Second time	Mean
Control	68.14 e	72.18 d	70.16 E
AA 2%	78.81 c	71.24 de	75.02 C
AA 4%	81.64 ab	78.38 b	80.01 B
NaCl 1.5%	65.85 f	60.54 f	63.2 F
NaCl 3%	83.93 a	85.38 a	84.65 A
DV 40%	73.79 d	76.07 bc	74.93 CD
DV 60%	80.12 bc	56.09 g	68.11 EF
AA + NaCl	70.38 ab	68.83 e	69.61 E
DV + NaCl	72.41 de	75.45 c	73.93 D
Ethanol 70%	53.79 g	53.72 gh	53.76 G
Mean	72.89 A	69.79 B	

Means with similar letters in each row and column are not significantly different at 5% level of DMRT.

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pH increase in acetic acid 4% treatment is confirmation of this subject, because in this treatment fruit ripening rate have been more than other treatments.

Generally measured factors in second spray time, were in higher level than first spray time. This effect is due to in second spray time; cells have more ability for starting to start of ripening in effect of stimulation of applied materials.

Generally, what fruit growth stages had been complete, growth regulators amount such as cytokinin and other effective matter is lower in conservation of cell and chlorophyll solidity in fruit texture, and hence applied material (treatments), have more severe effects on decreasing of cell solidity and increasing of enzyme activity in fruit mesocarp (Shabana *et al.*, 1981).

Otherwise, in this time, cells have higher ability for ethylene production in effect of stimulation by treatments (Bonded, 1976).

Table 5: Effect of treatment type and spray time on TSS

Spray time Treatment	First time TSS	Second time	Mean
Control	54 bc	66 a	60 A
AA 2%	60 a	54 c	57 B
AA 4%	54 bc	54 c	54 CD
NaCl 1.5%	51 c	54 c	52.5 D
NaCl 3%	60 a	60 b	60 A
DV 40%	54 bc	54 c	54 CD
DV 60%	60 a	54 c	57 B
AA + NaCl	57 ab	54 c	55.5 BC
DV + NaCl	54 bc	57 bc	55.5 BC
Ethanol 70%	54 bc	60 b	57 B
Mean	55.8 A	56.7 A	

Means with similar letters in each row and column are not significantly different at 5% level of DMRT.

Table 6: Effect of treatment type and spray time on pH

Spray time Treatment	First time pH	Second time	Mean
Control	6.73 c	6.58 g	6.66 D
AA 2%	6.84 b	6.81 d	6.82 B
AA 4%	6.55 d	7.04 a	6.8 B
NaCl 1.5%	6.9 ab	6.96 b	6.93 A
NaCl 3%	6.72 c	6.72 e	6.72 C
DV 40%	6.12 e	6.91 bc	6.52 E
DV 60%	6.93 a	6.87 c	6.9 A
AA + NaCl	6.89 ab	6.77 de	6.83 B
DV + NaCl	6.59 d	6.66 f	6.62 D
Ethanol 70%	6.84 b	6.76 de	6.8 B
Mean	6.71 B	6.81 A	

Means with similar letters in each row and column are not significantly different at 5% level of DMRT

Conclusion

Concerning to obtained results, acetic acid 4%, NaCl 3% and date vinegar 60% have very effect on early and even ripening of “Shahani” date fruit. These treatments were operated prominent decrease in Khalal percent than control, and crop were harvested sooner minimum one month. However, concerning undesirable quality and aspect Tamar and Khalal in acetic acid and date vinegar treatments, NaCl 3% is effective method in early and even ripening.

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